

The Exploration and Innovation in Teaching “Information Security Technology” Course for Graduate Students

Liuping Feng^{*1}, Hou Shu^{*2}, Lifang Yu^{*3}, Zhihong Dong^{*4}

School of Information Engineering, Beijing Institute of Graphic Communication

No.1, Xinghua Avenue (Band Two), Daxing District, Beijing, China, 102600

^{*1}lfpfeng@bigc.edu.cn; ^{*2}hou_shu@bigc.edu.cn; ^{*3}yulifang@bigc.edu.cn; ^{*4}dongzhihong@bigc.edu.cn

Abstract

“Information security technology” is an elective course for graduate students of Beijing Institute of Graphic Communication. We share our experience of the exploration and innovation in teaching the courses. The key technology of digital copyright protection is becoming the important part of information security. In order to meet the needs of digital publishing, we add new curriculum contents and explore teaching methodology. In the course teaching, we combine theory with practice, to cultivate the scientific research abilities of the graduate students.

Keywords

Information Security; Digital Copyright Protection; Teaching Methodology; Graduate Student

Introduction

With the rapid development of digital publishing, the problem of security is becoming more and more prominent. The piracy of digital works makes the intellectual property can not be protected effectively, the sales revenue of digital publishing enterprises is badly damaged, which seriously hinders the development of digital publishing industry. Therefore, to improve the cultivation of the graduate students on digital copyright protection is of great significance to promote the development of digital publishing industry.

Beijing Key Laboratory of Signal and Information Processing for High-end Printing Equipments, Beijing Institute of Graphic Communication carried out a series of work in digital copyright protection, such as digital rights management (DRM) technology, digital watermarking and information hiding technology, printing anti-counterfeiting technology. Combined with the scientific research, in the course of "information security technology" for graduate students, we emphasize the information security technology involved in digital copyright protection.

Innovation of Curriculum Content

In order to cultivate high level talents, it is needed to build a multi-level, diversified pattern and open graduate course system, which makes the graduate students have a solid basic theory, systematic and in-depth professional knowledge, comprehensive quality, practical ability and innovation ability.

Current Situation of “Information Security Technology” Course

Information security technology is a research field accompanied by the development of computer technology, and has become increasingly important. Information security technology is also an important course for computer science and technology. With the deepening of the research on information security technology and the perfection of the relevant theoretical system, the knowledge framework and teaching system of information security technology have been gradually formed.

The purpose of the "information security technology" course is to make students master the basic knowledge of information security and solve some common problems of information system security using basic technology of information security, to improve practical ability of students. It usually includes the following contents:

1) Cryptography Technology

Cryptography, such as public key and private key encryption, has become an important technology to provide the foundation for information security in many applications.

2) Digital Signature Technology

Digital signature is created using existing public key cryptography technology. This technology will permit commercial transactions to be carried out across insecure networks without fear of tampering or forgery.

3) Firewall Technology

Firewall is the first line to protect network security.

4) Intrusion Detection Technology

Network-based attacks have become common and sophisticated. For this reason, intrusion detection systems are now shifting their focus from the hosts and their operating systems to the network.

5) Network Attacks and Virus Protection

To prevent and defend networks from the occurrence of attacks, it is highly essential that the students have a broad knowledge of network attacks and virus protection.

There are a lot of excellent teaching materials in information security, such as "Cryptography and Network Security: principles and practices" (William Stallings), "security in computing" (Charles P. Pfleeger, et. al), and so on.

Innovation of "Information Security Technology" Teaching Material

With the development of digital publishing, the security problem of digital copyright protection is becoming more and more prominent, but the key technology of digital copyright protection is rarely systematically taught in "information security technology" course.

From 2010, the author has undertaken teaching task of "information security technology" for graduate student in Beijing Institute of Graphic Communication. It is the elective course for master degree graduate students of the communication and information system. The curriculum content covers not only the basic technology of information security, but also the key technology of digital copyright protection.

The most materials of information security generally introduce the basic knowledge and basic principle of information security, which are more suitable for general professional learning of information security. But there is a lack of introduction systematically about digital copyright protection technology.

In order to adapt to the development of digital copyright protection technology, we have written the teaching textbook "digital copyright protection technology and its application" for graduate students, which including the main technology of digital copyright protection, application and the latest progress. The students can have a deep knowledge about the basis contents and future trends of digital copyright protection. This textbook contains the following contents:

1) DRM Technology

The model and key technology of DRM system are introduced.

2) Encryption and Digital Signature Technology

This part introduces the conventional encryption and digital signature technology, and summarizes DRM encryption technology.

3) Digital Watermarking Technology

This part introduces the basic concept, classification and performance parameter of digital watermarking, the main digital watermarking algorithms, and robustness testing software—Stirmark.

4) Digital Fingerprinting Technology

The system model of digital fingerprint, digital fingerprint coding and digital fingerprint protocol are introduced.

5) DRM Standards

This part mainly introduces the DRM OMA standard in detail, and overviews the DRM AVS standard.

6) Rights Expression Languages

This part mainly introduces the rights expression languages based on XML —ODRL and XrML, and give an outline of LicenseScript, which is based on logic.

7) Anti-counterfeiting Printing Technology

This part mainly introduces the application of watermarking in the printing field.

Exploration of Teaching Methodology

At present, there is no complete theoretical system for graduate education, most of the research is to apply the theory of higher education, and there are few studies on the information security curriculum for graduate students. The teaching method for the graduate education and the undergraduate education should be different. At the undergraduate level, students are mainly to learn the basic theory and technology, but at the graduate level, they must improve their scientific research ability.

We share our experiences on the practice of teaching in "information security technology" course.

The Graduate Students Should Take Part in Discussion of Relevant Fields

While the textbook and material expose students to information security, discussion of relevant topics motivate students to explore information security techniques, providing a framework for a better understanding of the security topics.

Each topic of the course is consisted of a lecture and discussion. We explain some of the basic knowledge at first, then introduce the latest developments in the field, the papers and other materials. Through reading the materials, the graduate students have preliminary knowledge about the related fields. Then, students are allowed to pick a topic of their choice from a set of open research problems, write the summary reports and discuss in the class, that will motivate their learning initiative and improve their research ability.

Students' involvement in class is seen as paramount and the course is designed to encourage participation discussion.

The Graduate Teaching Should Be Driven by Scientific Research

The practical nature of many fields within information security is such that case studies are the most appropriate means by which participants can gain understanding of practices and, after analysis, the concepts behind those practices. Case studies are an integral part of the course and are used in all facets of the course. Textbooks, research and practitioner papers, and corporate "testimonials" are the key sources of cases. Through cases teaching to deepen understanding, the use of task drove teaching method to improve students learning interest.

In order to strengthen the ability to put what they learnt in the classroom into practice and improve the scientific innovation ability of the graduate students, we take advantage of Beijing Key Laboratory of Signal and Information Processing for High-end Printing Equipments, combining the research project in information security, let the

graduate students participate and guide the students in the Beijing Undergraduate Science Research project.

Science research projects require innovation ability of the participants, but also improve their abilities. In digital copyright protection technology, we focus on the research of anti-counterfeiting printing technology and digital publishing technology relying on National Natural Science Foundation of China and Key Projects of Beijing Institute of Graphic Communication. We introduce the cases of advanced technology and scientific research methods in digital copyright protection technology to enrich and enhance the academic accomplishment of students.

Conclusions

In this paper, the teaching methodology of "information security technology" for graduate students is discussed and summarized. We emphasize the key technology of digital copyright protection. In the course teaching, we combine theory with practice, to cultivate the scientific research abilities of the graduate students.

ACKNOWLEDGMENT

This paper is supported by Discipline Construction and Graduate Education Construction Project of Beijing Institute of Graphic Communication (No. 21090115027 and No. 21090115012).

REFERENCES

- [1] Stevens, Kenneth J., and R. Jamieson. "A popular postgraduate information systems security course." *Journal of Information Systems Education* 2002:219-225.
- [2] Huang, Jian Hua. "The Exploration and Innovation of Information Security Teaching Mode." *Science & Technology Information* (2012).
- [3] Liu, Fang. "Innovation Path Research on the Information Security Teaching based on the Engineering Practice Innovation." *Journal of Hubei Correspondence University* (2015).
- [4] Wang, Yu, and W. J. Han. "Design and Application of a New Teaching Method in Information Security Teaching." *Proceedings of the 2012 3rd International Conference on E-Business and E-Government - Volume 03 IEEE Computer Society*, 2012:345-347.
- [5] Liuping Feng. "Digital copyright protection technology and application", electronic industry press, 2013
- [6] Barth F, Luft M. Towards a practical approach for teaching IT-security. Presentation at the 3rd International Conference on Society and Information Technologies Conference (ICSIT 2012). Orlando, Florida. 2012.
- [7] Heinrichs L R. Engaging a diverse student audience in an information security course. *Issues in Information Systems*, 2015, 16(3).

Liuping Feng is a professor of Beijing Institute of Graphic Communication, China. Her research focuses on computer network, information security and digital copyright protection. She received her Ph.D. degrees in Computer Application Technology from Beijing Institute of Technology, China.

Hou Shu is an associate professor of Beijing Institute of Graphic Communication, China. Her research interests include digital media technology and watermark technology.

Lifang Yu is a Ph.D. in Signal and Information Processing. Her research work is focusing on information hiding.

Zhihong Dong is a Ph.D. in Signal and Information Processing. She specializes in Information Processing.